

Werner Heisenberg: Germany's Maligned Scientific Genius

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German physicist Werner Heisenberg (1901-1976) is widely regarded as one of the greatest physicists in world history.^[1] His contributions were crucial to the development of quantum physics during the first half of the 20th Century. Unfortunately, Heisenberg's reputation has been assailed because he worked on Germany's atomic-bomb project during World War II. This article shows that Heisenberg's slighted reputation is not justified, and that he risked his life in an effort to prevent the use of atomic bombs during the war.

Scientific Genius

Werner Heisenberg's scientific genius was apparent at an early age. Heisenberg's physics professor at the University of Munich, Arnold Sommerfeld, regarded Heisenberg as a brilliant student. Sommerfeld paid 20-year-old Heisenberg's expenses to travel with him to Göttingen in June 1922 to attend seven lectures by Danish physicist Niels Bohr. Although it was an unspoken rule that students do not contradict professors in public, Heisenberg strongly challenged Bohr's calculations after one of Bohr's lectures. The surprised Bohr invited Heisenberg for a long walk after the lecture to get to know Heisenberg.^[2] Thus began a close collaboration and friendship that became central to progress in quantum physics.^[3]

Heisenberg moved to Göttingen in October 1922 to work as Max Born's physics assistant. Born wrote a letter to Sommerfeld describing Heisenberg as a person of "exceptional talent, modest ways, zeal, enthusiasm, and good humor." Born later described Heisenberg in a letter to Bohr as "a young boy of rare charm and genius."^[4]

Heisenberg moved to Copenhagen in 1924 to work with Niels Bohr and his group of outstanding physicists. Physicist Victor Weisskopf wrote about Heisenberg:

Heisenberg had a special intuitive way of getting to the essential point. This, together with an incredible force of persistence and determination, made him the most prolific and successful physicist of the recent past. Whenever important problems turned up in the subsequent development of quantum mechanics, more often than not, it was Heisenberg who found the solution. He pointed to the direction of further developments by inventing new ways of looking at the situation. Apart from his fundamental contributions to the formulation of the quantum mechanics of the atom, he was able to decipher the helium spectrum that had puzzled the physicists for decades; he explained the magnetism of iron and similar metals; he paved the way to get a profound description of nuclear structure by considering the proton and the neutron as two states of the same basic particle. These are only a few of his outstanding contributions.^[5]

Heisenberg's best-known contribution to physics is the Heisenberg Uncertainty Principle. This principle states that one cannot simultaneously measure with absolute precision both the position and the momentum of an electron at any given instant. Heisenberg stated in his paper, published on March 22, 1927: "The more precisely we determine the position, the more imprecise is the determination of momentum in this instant, and vice versa." This discovery helped Heisenberg win the 1932 Nobel Prize in Physics.^[6]

Physics Professor

Heisenberg was appointed head of theoretical physics at Leipzig University in October 1927. On delivery of his inaugural lecture before the Leipzig faculty on February 1, 1928, Heisenberg became Germany's youngest full professor at Age 26.[\[7\]](#)

Heisenberg's genius and reputation attracted a talented group of doctoral students and research associates to Leipzig. Edward Teller, who earned his doctorate in physics under Heisenberg's tutelage, described Heisenberg as an excellent teacher who was kind to everyone. Teller wrote that openness and sharing characterized Heisenberg's physics group; nationality, religion and political opinion had no effect on one's welcome.[\[8\]](#)

Many physicists left Heisenberg's group when Adolf Hitler passed a law in April 1933 preventing Jews from holding jobs as civil servants. This law caused well over a thousand Jews in academic posts to begin looking for positions abroad.[\[9\]](#) Heisenberg strongly opposed the forced expulsion of Jewish scientists and despaired that he could do nothing to prevent it. Heisenberg wrote to physicist James Franck in early 1934: "I fear that a long time will pass before such a time of scientific enthusiasm will be possible once again in Germany. But I want to hold out here."[\[10\]](#) Heisenberg was committed to doing everything in his power to help German science.

Heisenberg also defended himself and theoretical physicists against attacks from German experimental physicists. The July 15, 1937 issue of the SS *Das Schwarze Korps* published an article by German experimental physicist Johannes Stark attacking Heisenberg as a "white Jew" who must be "eliminated just as the Jews themselves." Heisenberg wrote a letter directly to Heinrich Himmler requesting protection from such threatening attacks. Heisenberg's mother Annie, who was acquainted with Himmler's mother, visited Mrs. Himmler to have her deliver Heisenberg's letter directly to Heinrich Himmler.[\[11\]](#)

Heisenberg wrote a point-by-point rebuttal of Stark's charges in response to a letter from Himmler. Himmler then set in motion an intensive SS investigation that lasted more than eight months. Heisenberg made several trips to Berlin to defend his case, and on at least one trip he was interrogated in the basement chambers of the SS headquarters. Fortunately, the SS investigators assigned to Heisenberg's investigation had some training in physics, and they correctly described Heisenberg as an apolitical academic who was of great value to German physics. Himmler on July 21, 1938 sent an official letter to Heisenberg stating: "I do not approve of the attack of *Das Schwarze Korps* in its article, and I have proscribed any further attack against you." Heisenberg was exonerated and free to work in Germany.[\[12\]](#)

Physicists knew that building an atomic bomb was at least theoretically possible in January 1939, when they realized the uranium atom had been split when bombarded with neutrons. American physicists feared that Germany might build an atomic bomb before them. Heisenberg's physicist friends offered him several job opportunities in America when Heisenberg visited the United States in the summer of 1939. Heisenberg refused them all. He said he had a loyalty to his students and wanted to help rebuild German science after the war. Heisenberg did not know that his friends would consider him an enemy once the war started.[\[13\]](#)

Heisenberg's Atomic-Bomb Work

Heisenberg's atomic-bomb research began on September 26, 1939, when he was conscripted to join the War Office's Nuclear Physics Research Group. Heisenberg initially thought that only fissionable U-235 could be used to build an atomic bomb. The separation of U-235 from uranium (U-238) was an enormously complex and expensive undertaking because of the slight variation in weight of U-235 versus U-238. Niels Bohr stated in 1939 that the whole of the United States would have to be transformed into a factory in order to achieve enough fissionable U-235 for an atomic bomb. [\[14\]](#)

Carl Friedrich von Weizsäcker, Heisenberg's close friend and former student, discovered the new element plutonium. Weizsäcker and Heisenberg realized that plutonium was chemically separable from uranium, and that plutonium could be used as fissionable material in an atomic bomb. Since plutonium could be produced in a nuclear reactor, they knew construction of an atomic bomb was now feasible. [\[15\]](#)

German physicists decided to have Heisenberg travel to Copenhagen in September 1941 to talk in secret with Niels Bohr. Heisenberg had hoped that he could obtain Bohr's help in reaching an international agreement among physicists not to build an atomic bomb during the war. Bohr did not want to pursue Heisenberg's suggestion, and apparently did not trust Heisenberg's motives. Germany had driven many of its leading scientists into exile before the war, and it seemed to Bohr that Heisenberg was seeking to negate this Allied advantage in the development of atomic bombs. [\[16\]](#)

Elisabeth Heisenberg wrote about her husband's trip to see Niels Bohr:

So what was Heisenberg's ultimate concern during these discussions with Bohr? The truth was that Heisenberg saw himself confronted with the spectre of the atomic bomb, and he wanted to signal to Bohr that Germany neither would nor could build a bomb. That was his central motive. He hoped that the Americans, if Bohr could tell them this, would perhaps abandon their own incredibly expensive development. Yes, secretly he even hoped that his message could prevent the use of an atomic bomb on Germany one day. He was constantly tortured by this idea. [\[17\]](#)

An important point concerning Heisenberg's meeting with Bohr is that Heisenberg had no official authority to tell Bohr anything about the German atomic-bomb project. Heisenberg had committed an act of treason by attempting to obtain an international agreement among physicists not to build an atomic bomb during the war. Heisenberg had courageously risked his life by so talking to Bohr. [\[18\]](#)

In a meeting on June 4, 1942, Heisenberg and other nuclear scientists told Albert Speer that Germany did not have the resources to construct an atomic bomb during the war. Germany focused only on building a nuclear reactor, and this project enabled many German scientists to avoid military service on the Eastern Front. Heisenberg had guided Germany's atomic-bomb program into a small, poorly funded project that posed no threat to anyone. [\[19\]](#)

Target: Heisenberg

Werner Heisenberg was considered by many to be the world's greatest practicing physicist at the start of World War II. It was universally believed Heisenberg was the one German with the genius to build an atomic bomb. British physicist James Chadwick told American officials that he considered Heisenberg "the most dangerous possible German in the field because of his brain power..." Robert Oppenheimer told a young intelligence officer that "the position of Heisenberg in German physics is essentially unique.

If we were undertaking [a bomb project] in Germany, we would make desperate efforts to have Heisenberg as a collaborator.” [20]

With so much fear of Heisenberg’s brain, it was inevitable that the Allies would attempt to solve the problem by getting Heisenberg out of the way. British and American bombers intentionally targeted buildings in Berlin where Heisenberg and other scientists were thought to be working. These Allied bombings were made primarily to kill the German scientists involved in the atomic-bomb project. German scientists were forced to move their operations outside the city of Berlin as a result of these bombings. [21]

American physicists also proposed illegal means of eliminating Heisenberg. Upon learning that Heisenberg was visiting neutral Switzerland in December 1942 to give lectures on S-matrix theory, Victor Weisskopf wrote a three-page letter to Robert Oppenheimer proposing a plan to kidnap Heisenberg in Switzerland. This kidnapping plan was discussed and supported by Hans Bethe, Samuel Goudsmit, Edward Teller, Leo Szilard and Eugene Wigner. Oppenheimer replied thanking Weisskopf for his “interesting letter,” saying he already knew the central facts and had passed them on to “the proper authorities.” These Jewish physicists did not care that kidnapping Heisenberg in neutral Switzerland was against international law, nor did they scruple to conspire against their former colleague and mentor. [22]

Heisenberg’s kidnapping was not attempted, but American military intelligence devised a plan to possibly murder Heisenberg when he visited neutral Switzerland in December 1944. OSS agent Moe Berg was assigned to attend Heisenberg’s lecture on S-matrix theory. Berg had been drilled in physics and understood German. If anything Heisenberg said convinced Berg that Germany was close to building an atomic bomb, Berg’s assignment was to kill Heisenberg with a gun Berg had been issued in Washington. [23]

Berg wrote during Heisenberg’s lecture: “As I listen, I am uncertain—see: Heisenberg’s uncertainty principle—what to do to H...discussing math while Rome burns—if they knew what I’m thinking.” Fortunately, Berg did nothing. Heisenberg in his lecture and during a party afterwards gave no indication that Germany was close to building an atomic bomb. Berg correctly concluded in his report to Washington that there would be no German atomic bomb. [24]

Heisenberg had been unaware of the potential kidnapping and murder plans against him. While interned after the war along with nine other German scientists in Farm Hall in Great Britain, Heisenberg referred to Robert Oppenheimer as a person who means well. [25] Heisenberg did not know that Oppenheimer and other American physicists had wanted to illegally kidnap him in neutral Switzerland during the war.

Heisenberg’s Wartime Accomplishments

Almost alone among the great physicists of the world, Werner Heisenberg continued to do important theoretical research during World War II. Heisenberg wrote several scientific papers and a book titled *Vorträge über Kosmische Strahlung* that was published in 1943. [26]

Heisenberg traveled to the Netherlands in October 1943 to help Dutch physicists. Heisenberg gave six talks in as many cities and reopened scientific exchanges with numerous colleagues. More important, Heisenberg quashed a German order to ship Dutch scientific equipment to Germany, reopened the

physics laboratory at the University of Leiden, and eased travel restrictions that had trapped Dutch colleagues. Hans Kramers wrote to Heisenberg “to tell you once more how happy your visit has made me, stimulating again old ideals.” Kramers was not the only Dutch physicist to express such gratitude.[\[27\]](#)

Heisenberg also prevented Niels Bohr’s institute in Copenhagen from being confiscated by the German government. After Niels Bohr had escaped to Sweden, a detachment of German military police seized Bohr’s institute in December 1943. Heisenberg spent three days in Copenhagen in January 1944 with German officials and persuaded them to return Bohr’s institute to Danish control. Heisenberg demonstrated how difficult it would be to dismantle the complex equipment in the institute for shipment to Germany. He also proved to German officials that none of the institute’s work involved secret war research. Based on Heisenberg’s recommendations, the institute was returned to Danish control “without official conditions,” and a physicist who had been imprisoned was released from jail.[\[28\]](#)

Heisenberg prevented Polish physicist Edwin Gora from being sent to German concentration camps while also enabling him to complete his Ph.D. thesis. Gora wrote after Heisenberg’s death:

I contacted Heisenberg, who promptly invited me to come to Leipzig. There he made arrangements for me to register as a foreign student, and to get a part time job as a streetcar conductor. As such, I got a foreign laborers’ permit to stay in Germany. This arrangement worked during 1940, and I could attend classes regularly including Heisenberg’s lectures on relativity. In early 1941, I was picked up by the Gestapo, but later released, so far as I know, thanks to Heisenberg’s intervention. Authorities in my hometown had classified me as a “deutschfeindlicher Pole” (a Pole hostile to Germany), which normally would have implied a concentration camp and poor chances for survival. After this, I was no longer permitted to enter Institute premises, but Heisenberg made arrangements to see me privately, and to keep me supplied with all the materials needed to complete my thesis, which was eventually published without Institute address...[\[29\]](#)

Heisenberg also helped save the life of a German man after Allied bombing in Berlin on March 1, 1943. A young woman who had been calling for help told Heisenberg that her old father was still up in the attic fighting a losing battle against the flames. Since the stairway had collapsed, she did not know how her father could be brought down. Heisenberg scaled the walls to the roof, and managed to get the old man down along the same route he had clambered up.[\[30\]](#)

Conclusion

A faint hope that the world’s physicists might conspire not to build atomic bombs during the war brought Werner Heisenberg to visit Niels Bohr in Copenhagen. Under the stress of war, the two great physicists could not communicate. They eventually decided after the war not to discuss what was said during Heisenberg’s visit to Copenhagen. The friendship of Werner Heisenberg and Niels Bohr, once so close and fruitful, was never fully revived. They maintained a polite and cordial relationship, but their close bond of friendship ended after World War II.

Despite Heisenberg’s noble actions during World War II, many physicists shunned Heisenberg after the war because he had worked for Adolf Hitler. As American physicist John Wheeler wrote, “Heisenberg died in 1976 at the age of 74, with fewer friends than he deserved.”[\[31\]](#)

Endnotes

[1] <https://www.famousscientists.org/the-10-greatest-physicists-in-history/>.

[2] Cassidy, David C., *Beyond Uncertainty: Heisenberg, Quantum Physics, and the Bomb*, New York: Bellevue Literary Press, 2009, pp. 99-100.

[3] Teller, Edward, *Memoirs: A Twentieth-Century Journey in Science and Politics*, Cambridge, Mass.: Perseus Publishing, 2001, p. 65.

[4] Greenspan, Nancy Thorndike, *The End of the Certain World: The Life and Science of Max Born*, New York: Basic Books, 2005, pp. 116, 284.

[5] Heisenberg, Elisabeth, *Inner Exile: Recollections of a Life with Werner Heisenberg*, Boston, Mass.: Birkhäuser, 1984, p. x.

[6] Cassidy, David C., *Beyond Uncertainty: Heisenberg, Quantum Physics, and the Bomb*, New York: Bellevue Literary Press, 2009, pp. 159-161, 217.

[7] *Ibid.*, p. 172.

[8] Teller, Edward, *Memoirs: A Twentieth-Century Journey in Science and Politics*, Cambridge: Mass.: Perseus Publishing, 2001, pp. 57, 59.

[9] Powers, Thomas, *Heisenberg's War: The Secret History of the German Bomb*, New York: Alfred A. Knopf, 1993, p. 185.

[10] Cassidy, David C., *Beyond Uncertainty: Heisenberg, Quantum Physics, and the Bomb*, New York: Bellevue Literary Press, 2009, p. 215.

[11] *Ibid.*, pp. 268-274.

[12] *Ibid.*, pp. 274-280.

[13] Powers, Thomas, *Heisenberg's War: The Secret History of the German Bomb*, New York: Alfred A. Knopf, 1993, pp. III-X, 3, 12.

[14] Cornwell, John, *Hitler's Scientists: Science, War and the Devil's Pact*, New York: Penguin Books, 2003, p. 299.

[15] Powers, Thomas, *Heisenberg's War: The Secret History of the German Bomb*, New York: Alfred A. Knopf, 1993, pp. 78, 101, 116.

[16] *Ibid.*, p. 117-118.

[17] Heisenberg, Elisabeth, *Inner Exile: Recollections of a Life with Werner Heisenberg*, Boston, Mass.: Birkhäuser, 1984, p. 79.

[18] Powers, Thomas, *Heisenberg's War: The Secret History of the German Bomb*, New York: Alfred A. Knopf, 1993, p. 511.

- [19] Cassidy, David C., *Beyond Uncertainty: Heisenberg, Quantum Physics, and the Bomb*, New York: Bellevue Literary Press, 2009, pp. 330-331.
- [20] Powers, Thomas, *Heisenberg's War: The Secret History of the German Bomb*, New York: Alfred A. Knopf, 1993, pp. IIX-IIX, 66.
- [21] *Ibid.*, pp. IIX, 210-211, 333, 335-336.
- [22] *Ibid.*, pp. 168, 183, 192-193.
- [23] *Ibid.*, pp. 393, 398-399.
- [24] *Ibid.*, pp. 399, 401-403.
- [25] Bernstein, Jeremy, *Hitler's Uranium Club: The Secret Recordings at Farm Hall*, 2nd edition, New York: Copernicus Books, 2001, p. 278.
- [26] Powers, Thomas, *Heisenberg's War: The Secret History of the German Bomb*, New York: Alfred A. Knopf, 1993, pp. 315, 360.
- [27] *Ibid.*, p. 327.
- [28] *Ibid.*, pp. 329-331.
- [29] *Science News*, Vol. 109, p. 179, March 20, 1976.
- [30] Heisenberg, Werner, *Physics and Beyond: Encounters and Conversations*, New York: Harper & Row, 1971, pp. 183, 188-189.
- [31] Wheeler, John Archibald, *Geons, Black Holes, and Quantum Foam: A Life in Physics*, New York: W. W. Norton & Company, 1998, p. 43.

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